

High-Cadence Supernova Survey

Masaomi Tanaka

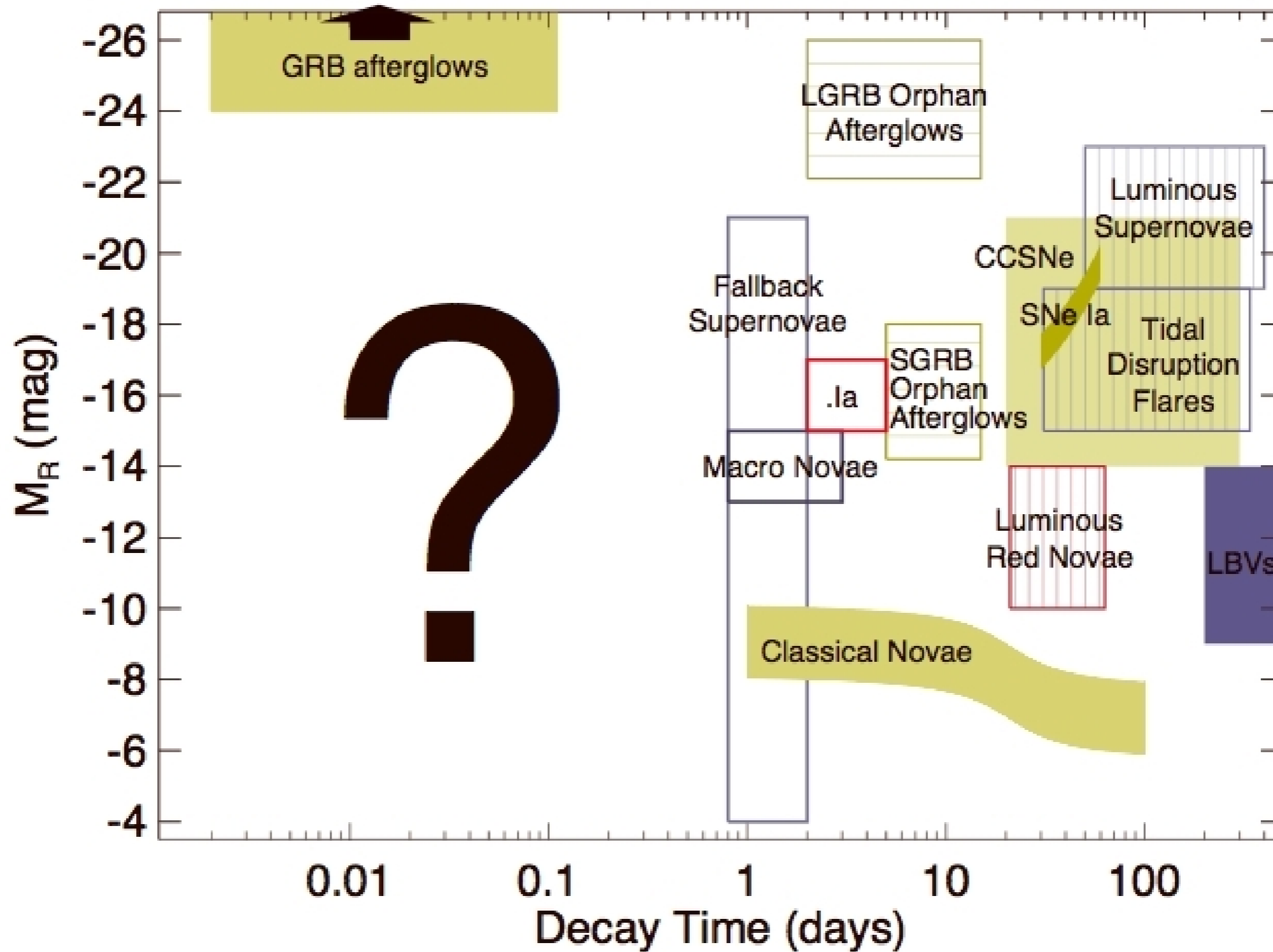
(National Astronomical Observatory of Japan)

in collaboration with

Tomoki Morokuma (Univ. Tokyo)

Nozomu Tominaga, Kensho Mori (Konan Univ.)

many other collaborators



SN shock breakout

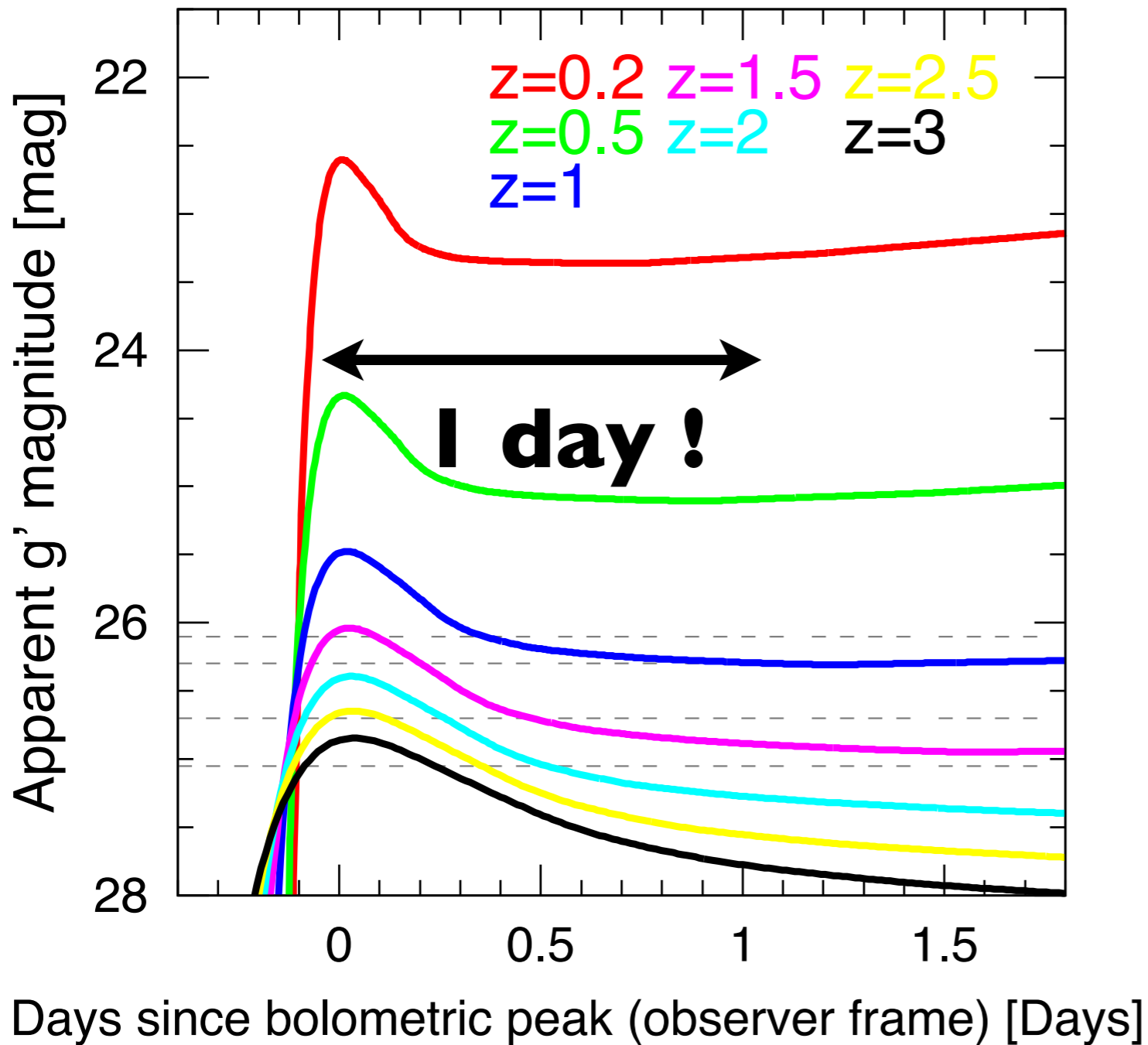
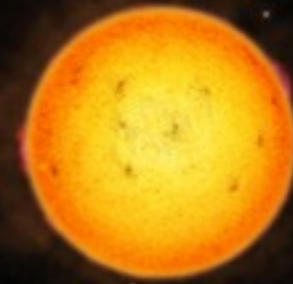


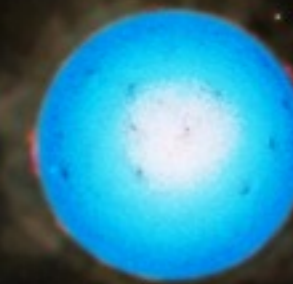
Figure from N. Tominaga

Nozomu's talk

progenitor star



Breakout

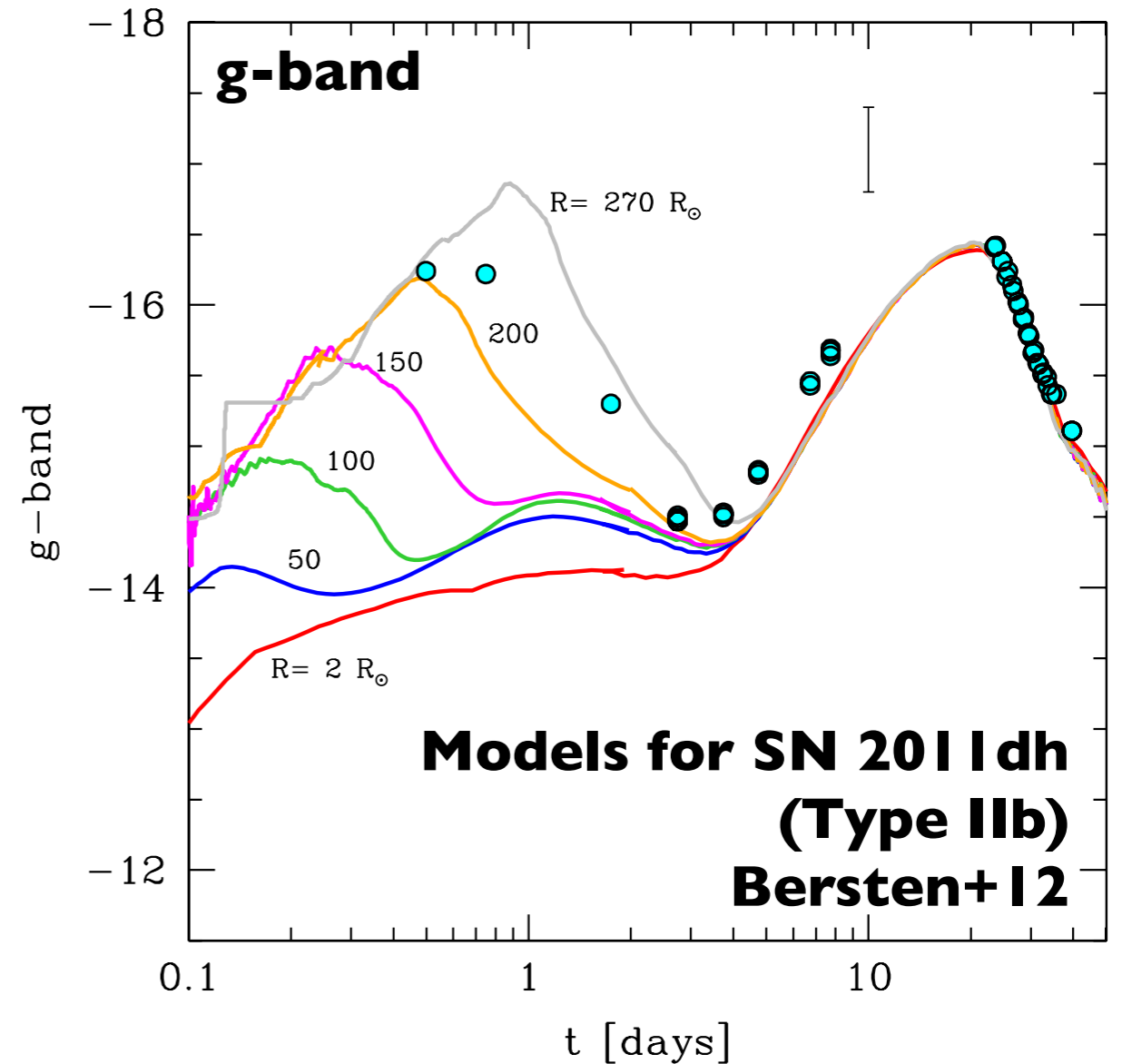
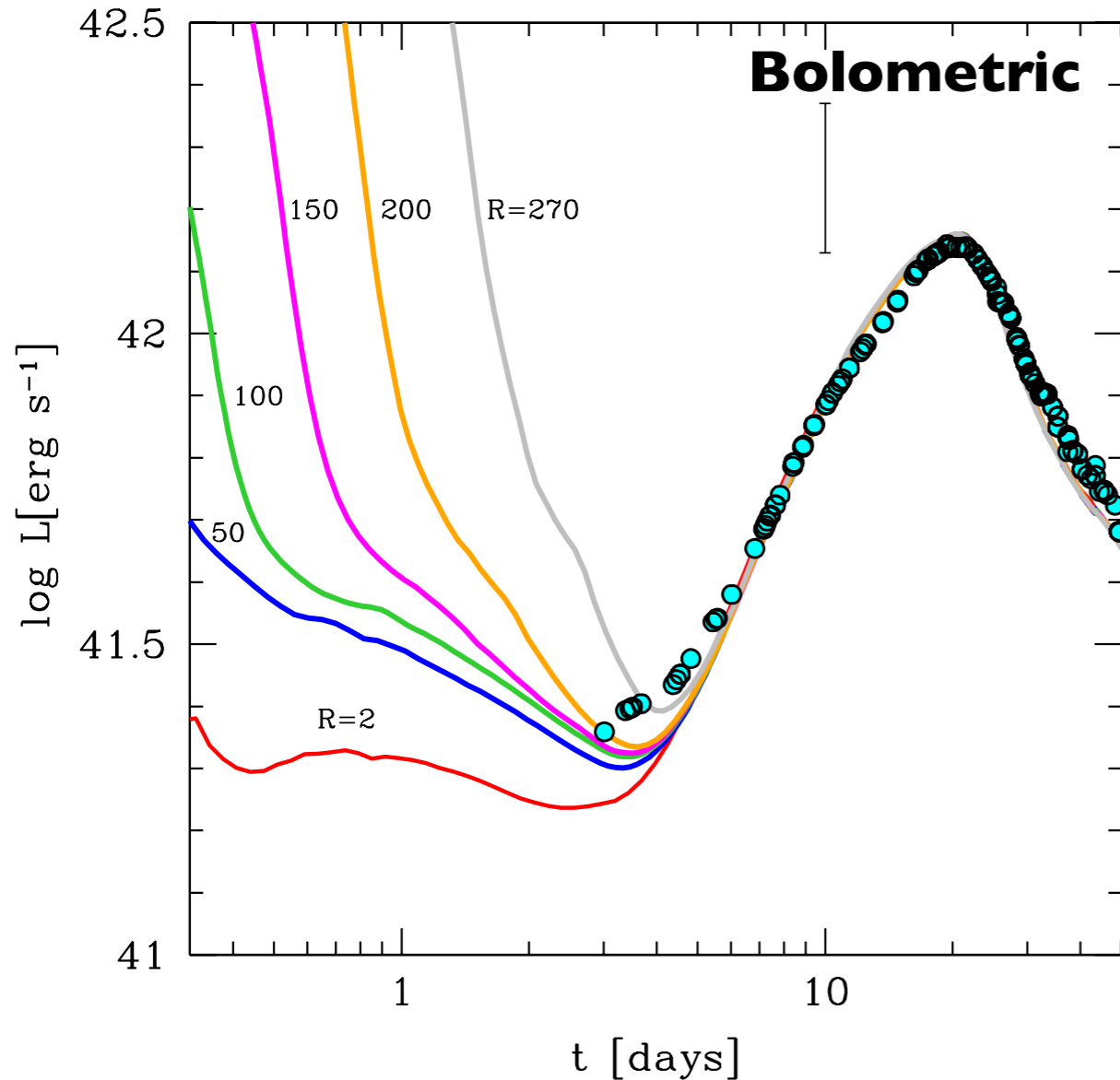


> a few days

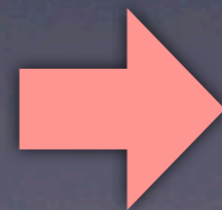


Figure from T. Morokuma

Type IIb SN 2011dh



It's too late with
classical 2-3 days cadence



**High-Cadence
SN Survey**

Kiso observatory (1974~)

Altitude: 1130m



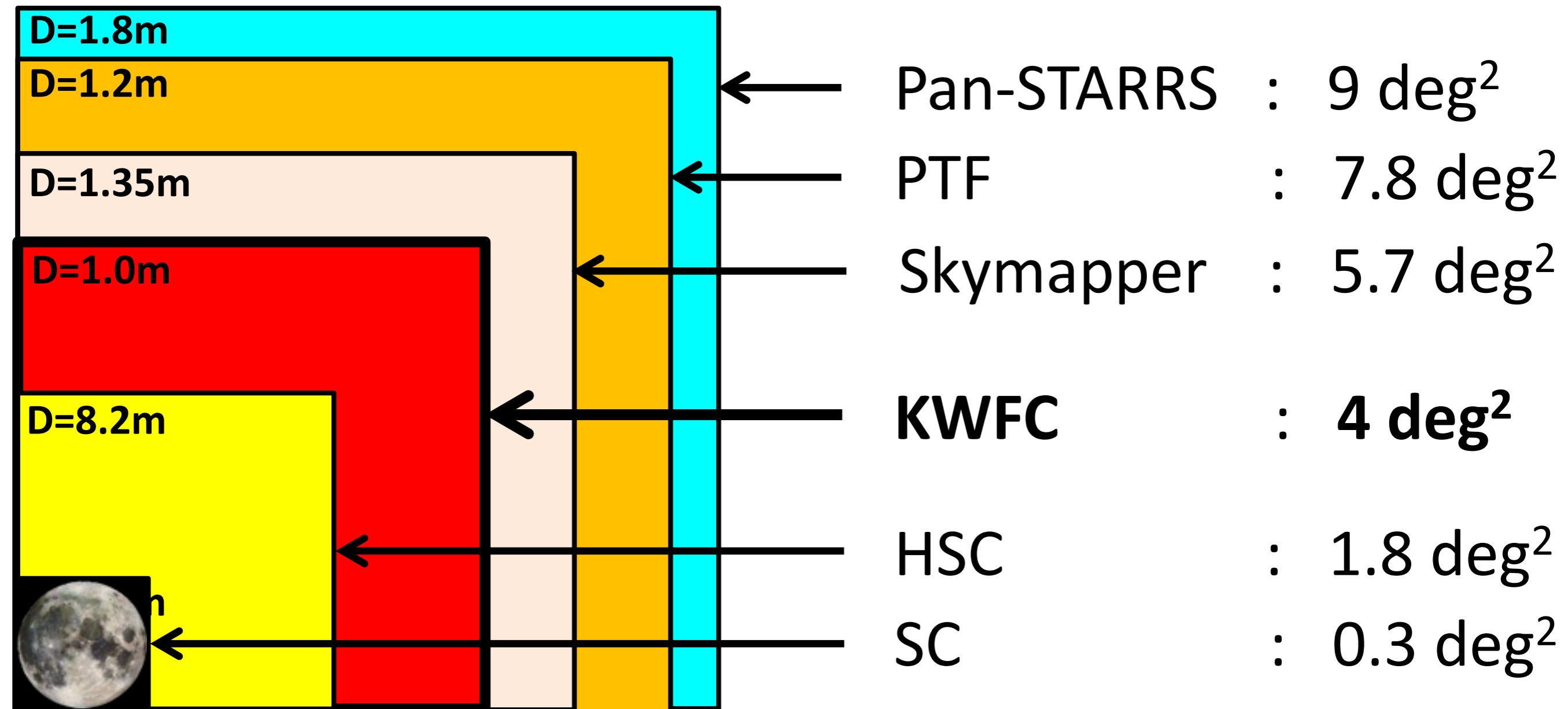
1.05m Schmidt Telescope



KWFC = Kiso Wide Field Camera

(4k x 2k chip) x 8
1 arcsec/pix

Slide from Shigeyuki Sako



Supernova Survey with KWFC

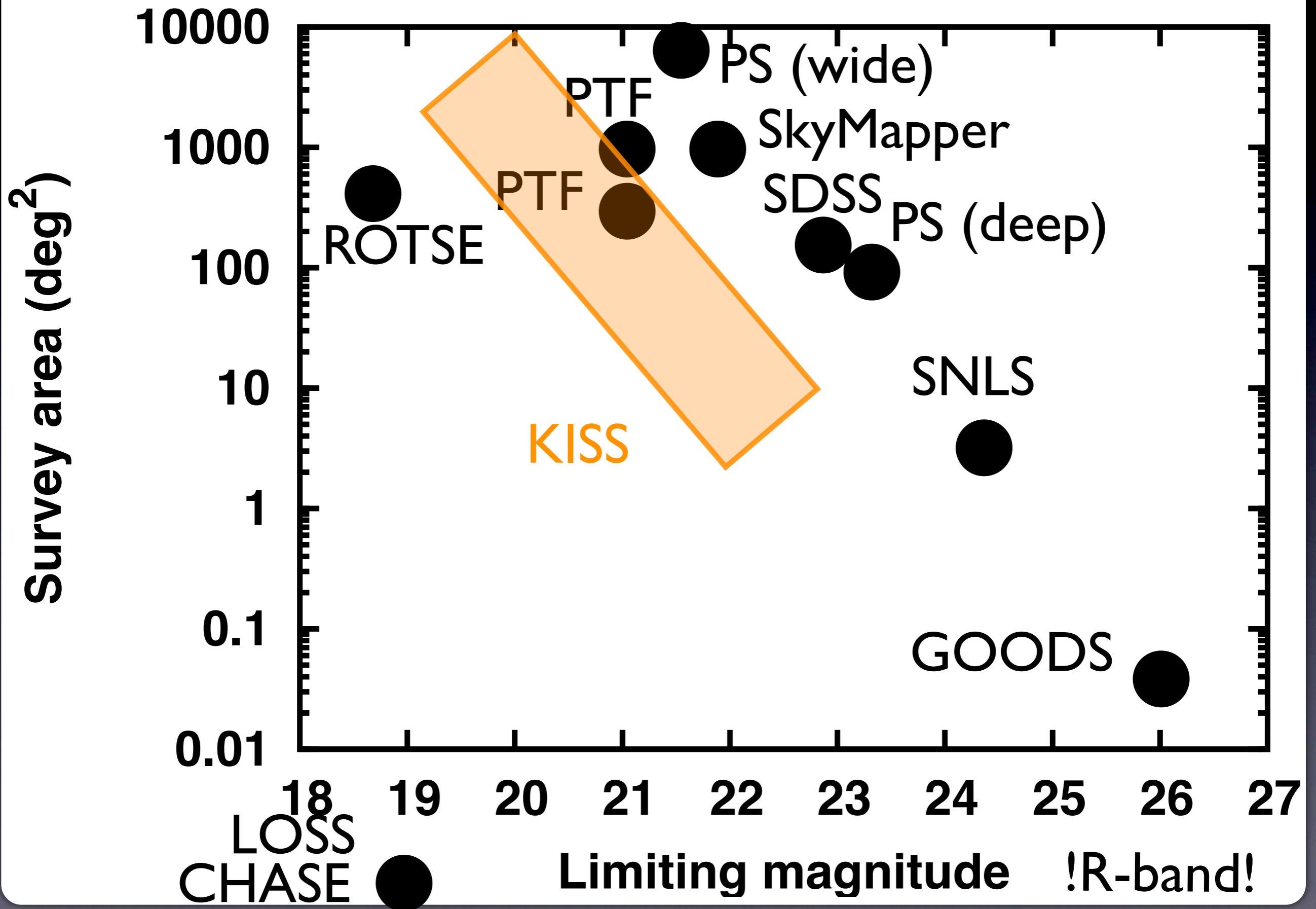
KISS: Kiso **S**upernova **S**urvey

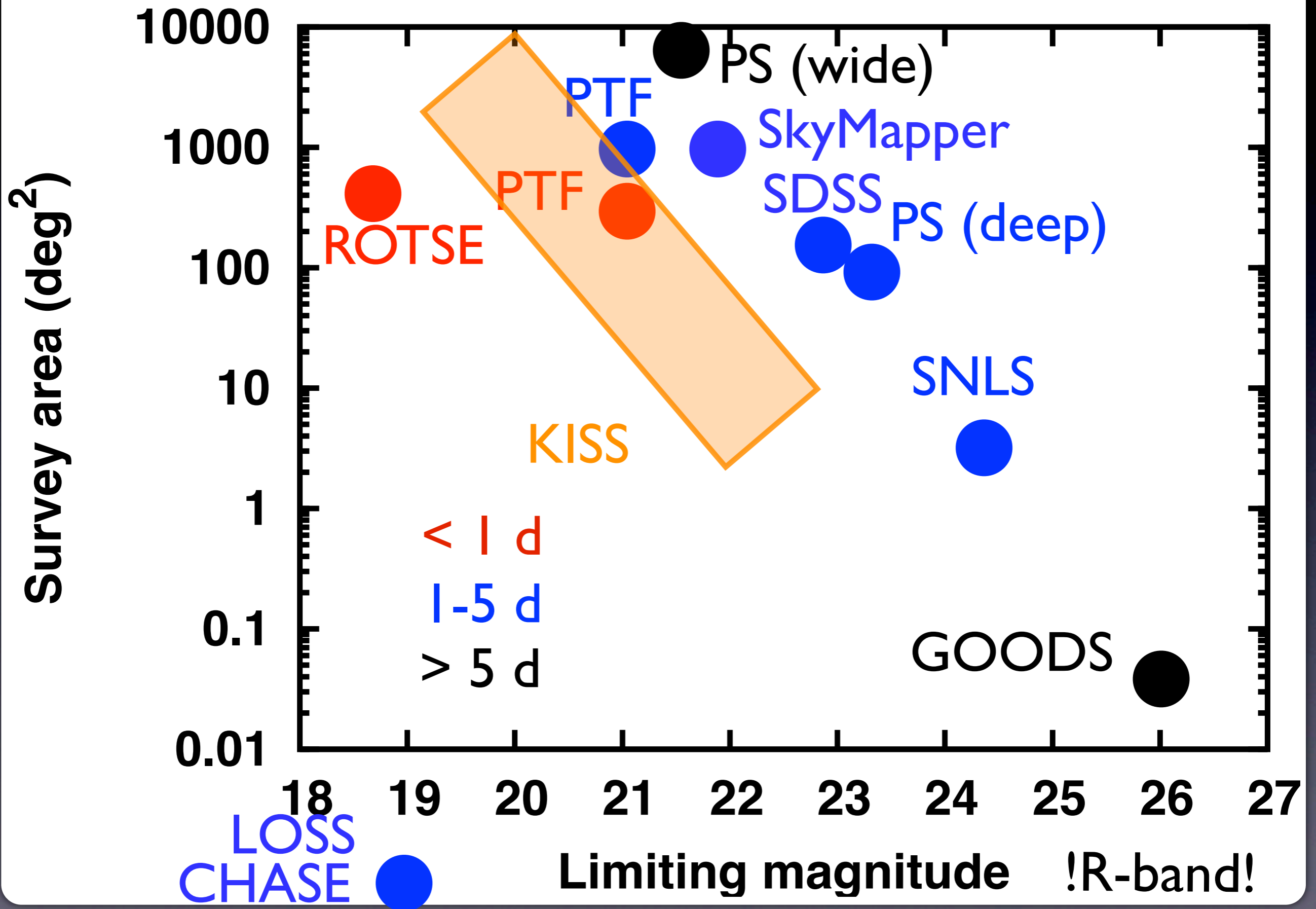
- **Extremely high cadence**
 - **1-hr cadence**
 - **3 min exposure**
 - **~ 21 mag in g-band**
 - **~50-100 deg² /day**
 - **High SFR field (within $z=0.05$, 30-100 Msun/yr)**

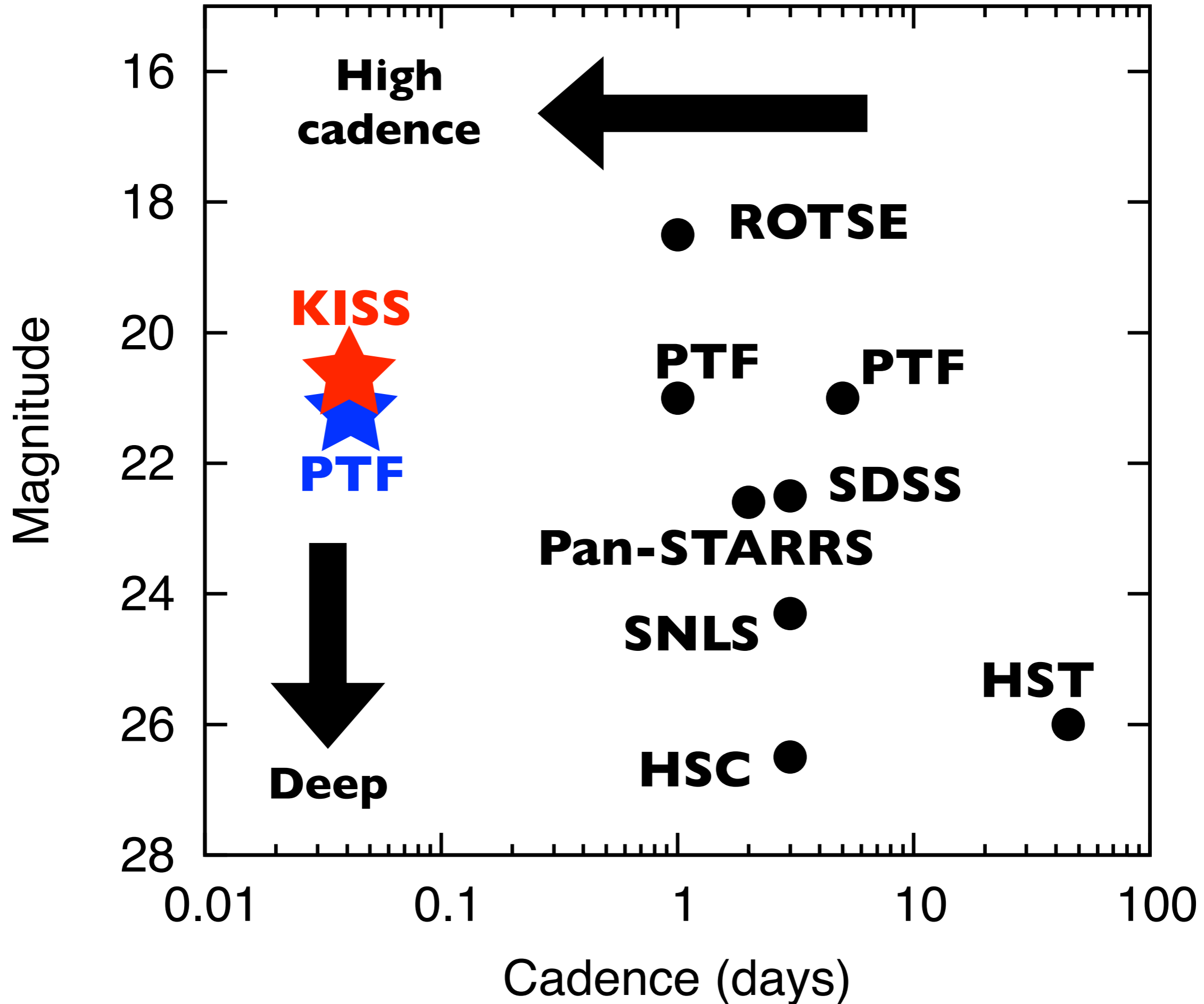
PI: Tomoki Morokuma (Univ. Tokyo)

2012/04: Dry run -

2012/09: Main survey -





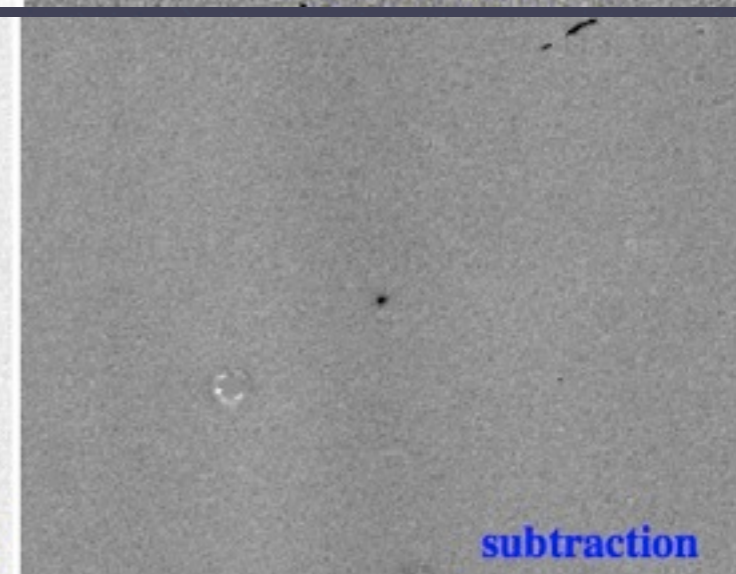
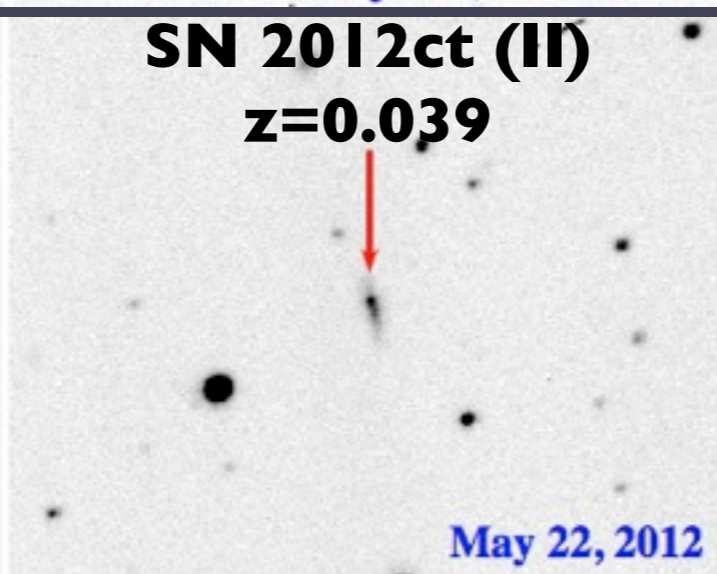
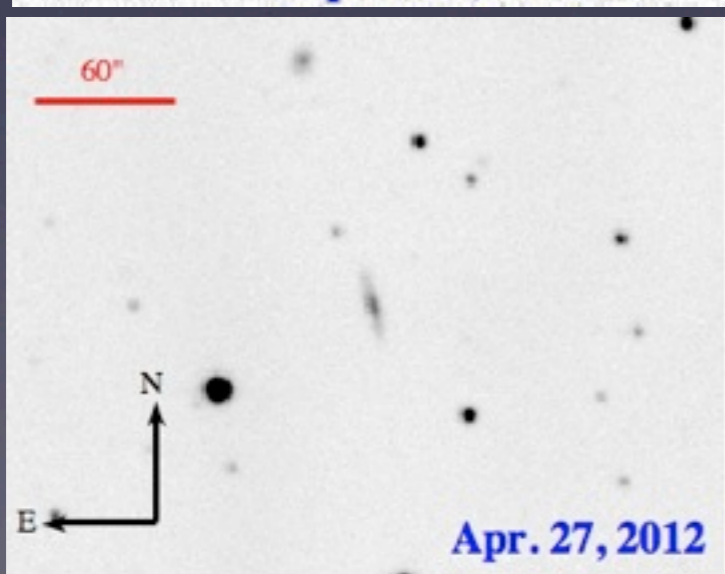
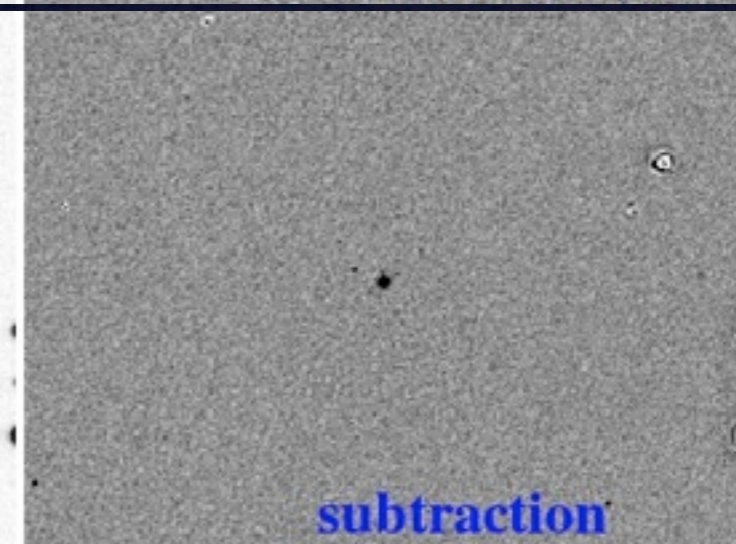
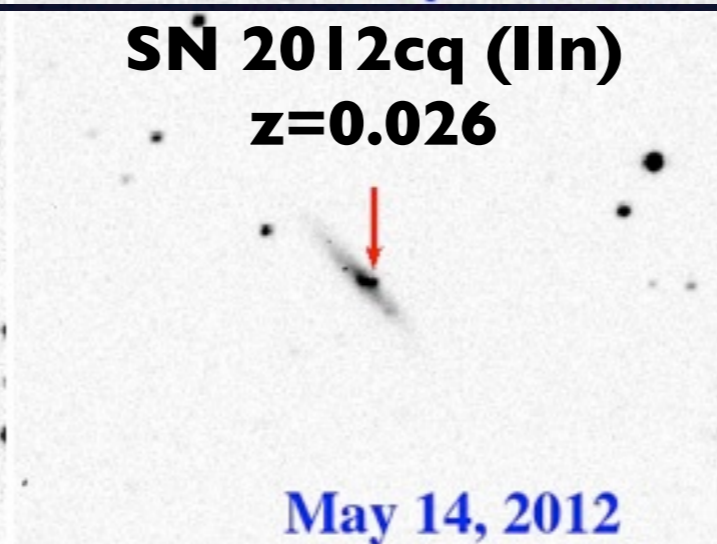
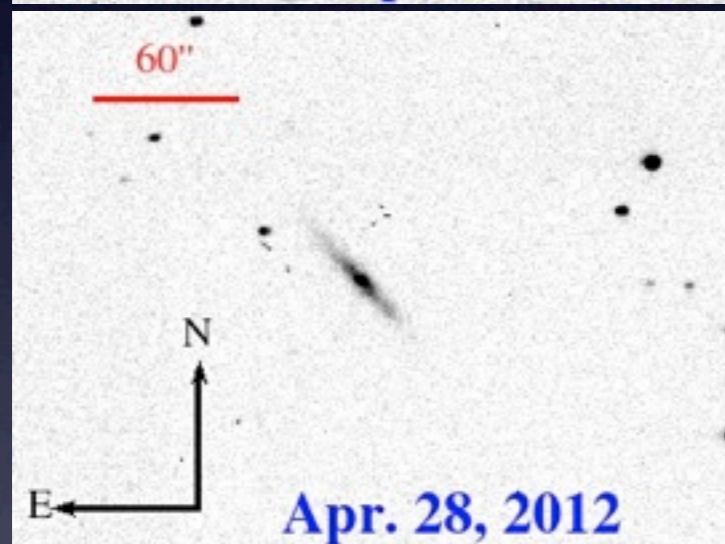
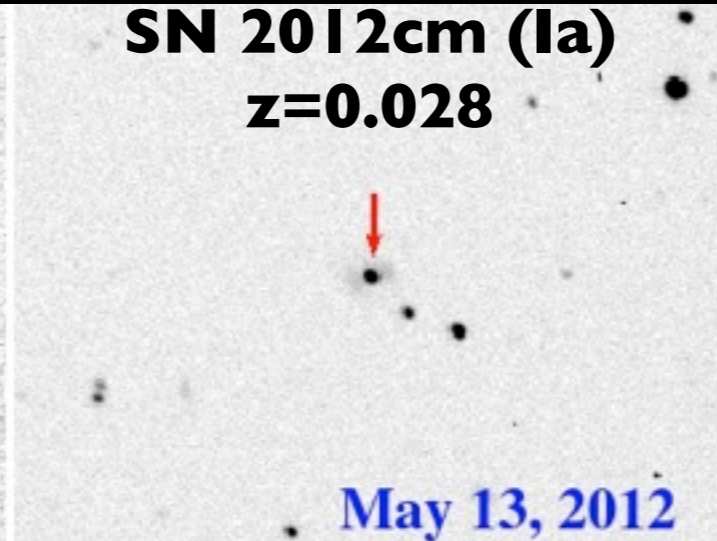
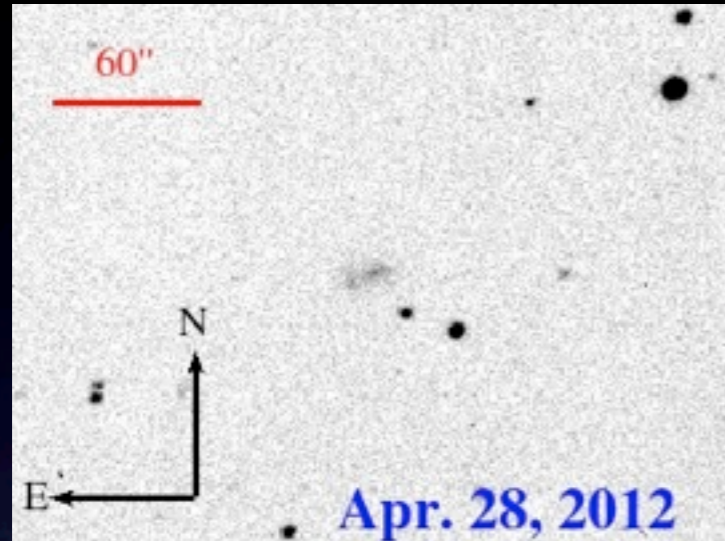


First KISS!

Reference

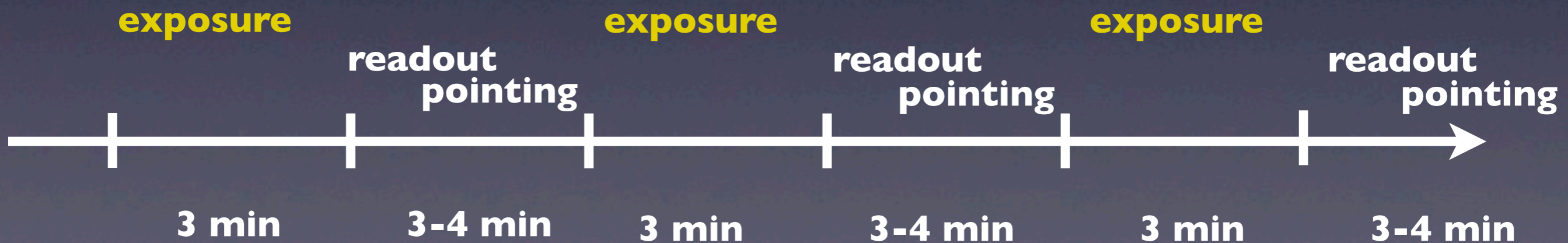
New

Subtracted



Operation

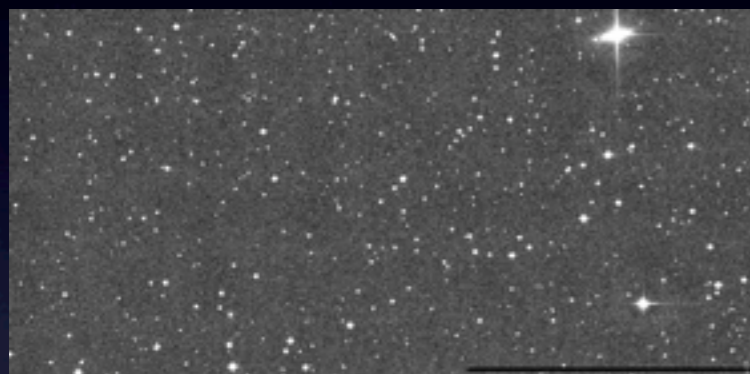
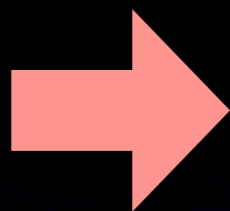
- ~ 100 nights / yr (around new moon)
Intensive program at Kiso observatory (3 yr)
- 30-40% good weather
- 3 arcsec seeing
- half-automatic observations
(someone should be at the observatory)



Kiso observatory



KISS pipeline



standard reduction

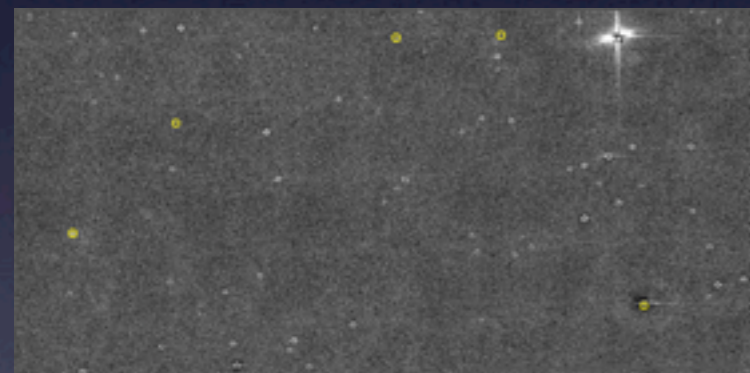


image subtraction

source detection

< 10 min

~ 50GB/day

cut-out images

Ref

New

Sub

KISS database

source
info

Tokyo

cut-out images

Ref

New

Sub

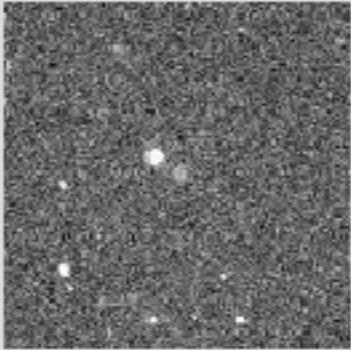

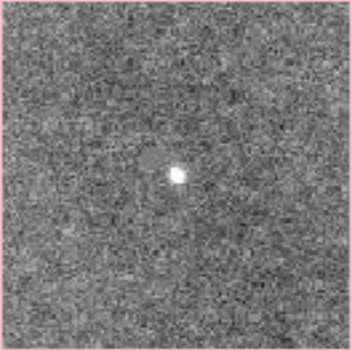
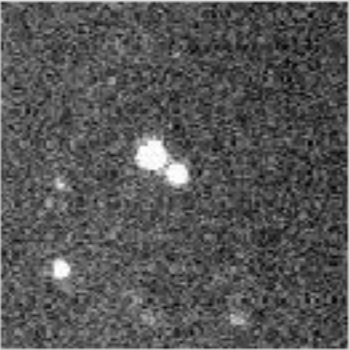
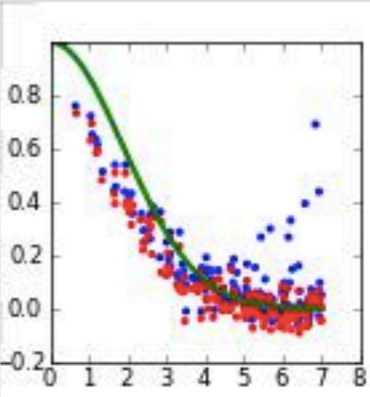
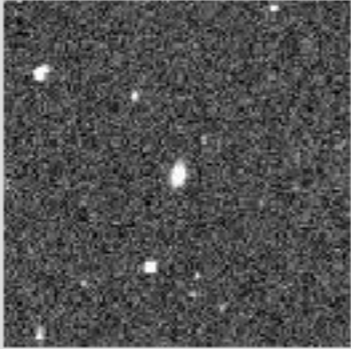
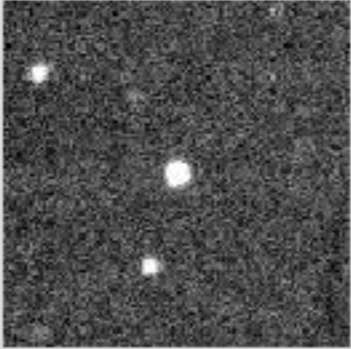
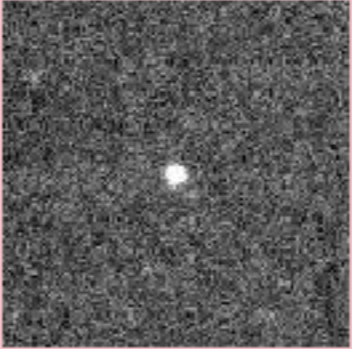
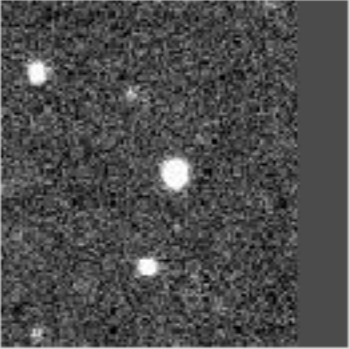
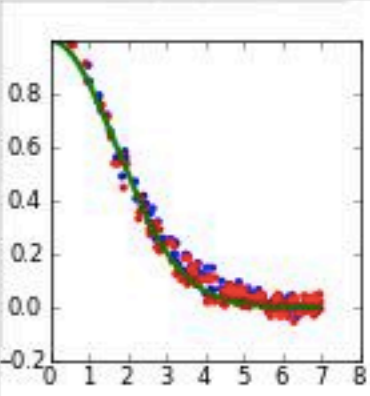
KISS database

source
info

KISS interface



Realtime check
Amateur astronomers

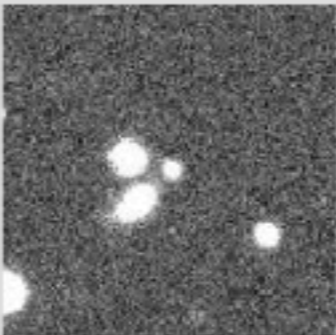
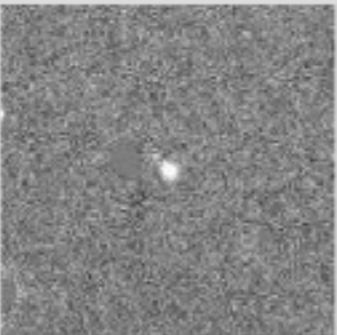
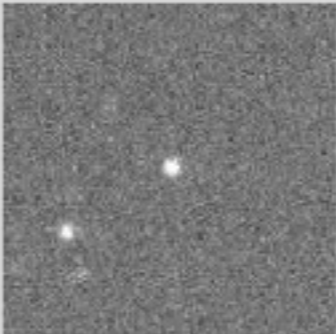
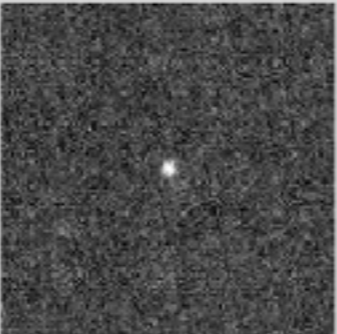

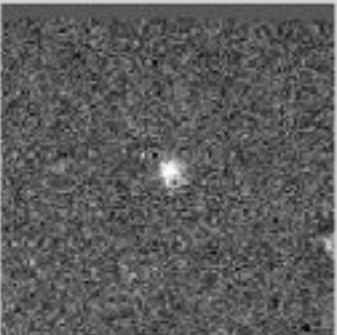
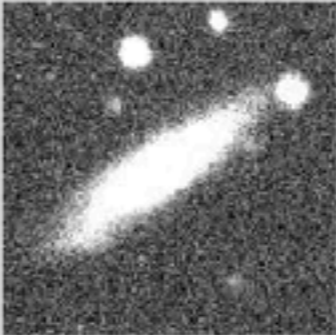
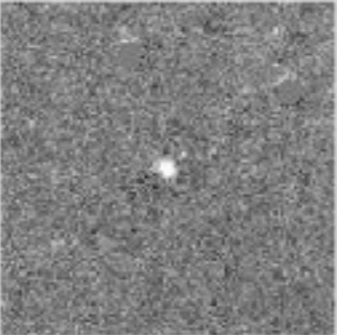

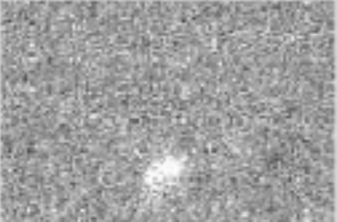
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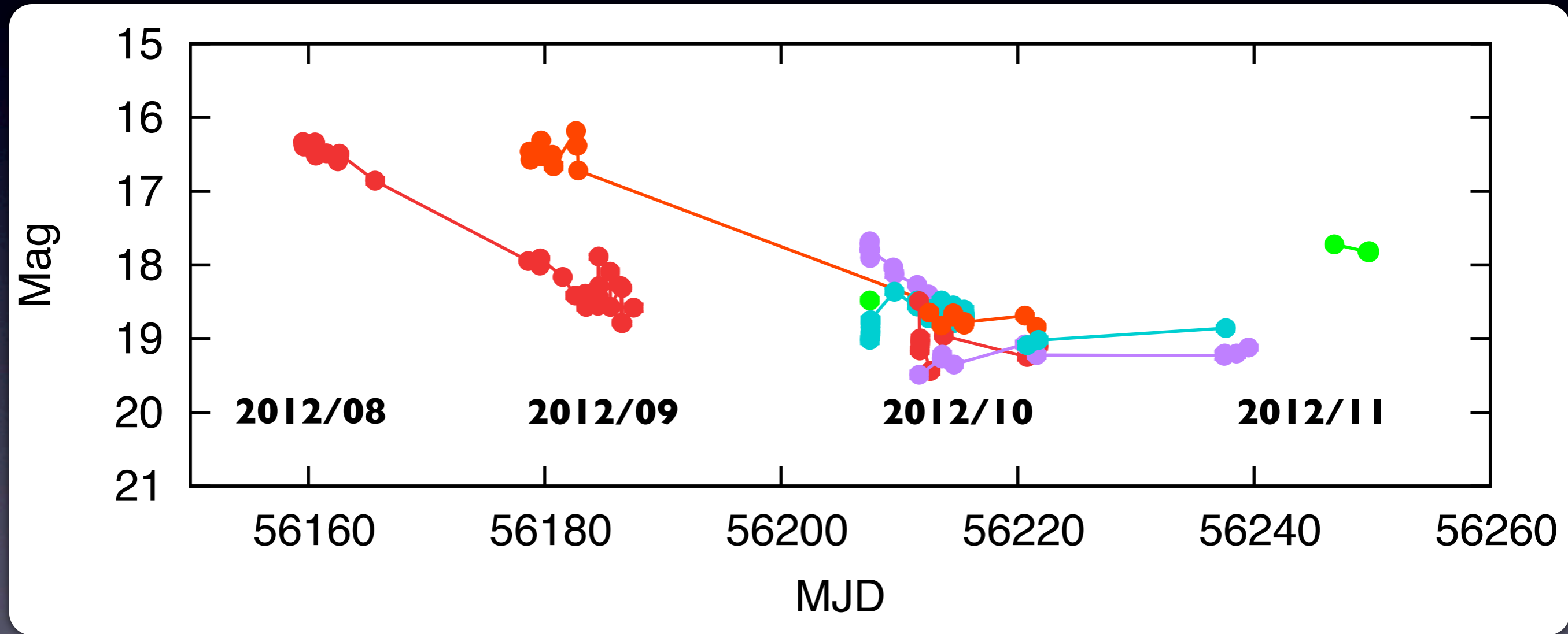
**Realtime check
by KISS members and
amateur astronomers in Japan**

18 SNe (and SN candidates) so far

KISS Supernova List

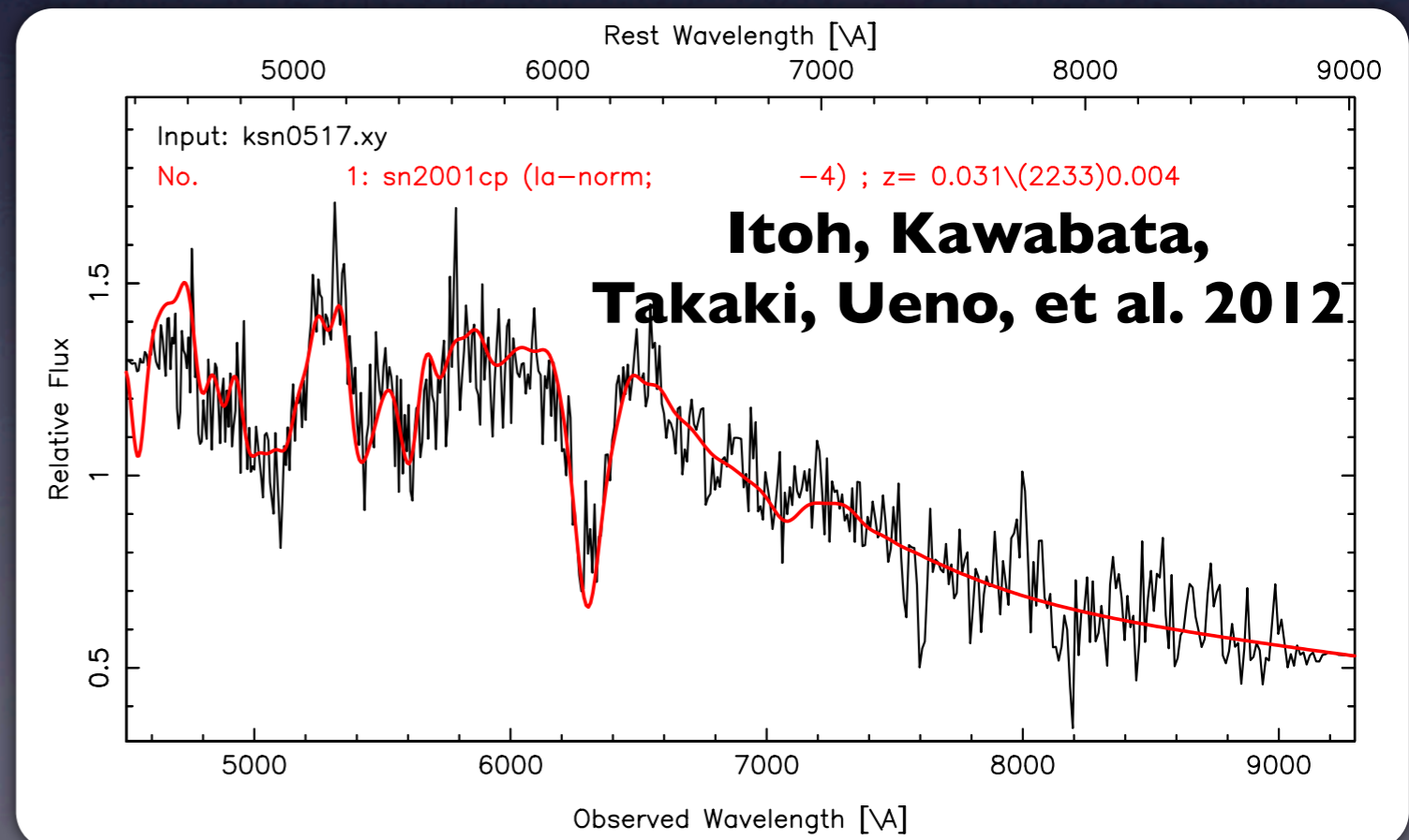
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Light curves



Follow-up

- 1-2m telescopes in Japan (Koji's talk)
- Mini-TAO at Chile
- 3.6m TNG (Walker, Pian, Mazzali et al.)
- 2m HCT (Sahu, Anupama et al.)
- Under discussion



Initial Results (half a year)

- **18 SN candidates**
(consistent with expectation)
 - **3 IAU SNe**
 - **3 overlap with PTF,**
2 with La-Silla QUEST, 2 with CRTS
- **No shock breakout candidates**
(Last non-detection epoch is usually
2 days - 2 weeks ago)
- **Other variable sources**
 - **Rapid flare (with ~1 hr duration)**
 - ~ 30 variability selected AGNs
 - ~ 40 variable stars

KISS: KIso **S**upernova **S**urvey

- **Extremely high-cadence survey**

- **1-hr cadence**

- **3 min exposure**

- **~ 21 mag in g-band**

- **~50-100 deg² /day**

- **100 nights / year**

- **Initial results**

- **18 SN candidates,
but no SN shock breakout**



KISS Members

- Tomoki Morokuma (PI) standard pipeline, survey strategy
- Masaomi Tanaka transient pipeline, web interface
- Nozomu Tominaga survey strategy, transient pipeline
- Kensho Mori operation

- Noriyuki Matsunaga standard pipeline
- Michael Richmond standard pipeline
- Shigeyuki Sako KWFC
- Nobuharu Ukita operation
- Kiso observatory staff operation, telescope
- KISS collaborators Y.Aoki, H.Akitaya, Y. Ita, R. Itoh, I. Ueno, Y Urata, T. Urano, S. Okamura, N. Kawai, K. Kawabata, S. Koshida, Y. Saito, T. Sakamoto, K. Takaki, M. Tanaka, A. Tomita, K. Nakata, H. Nakanishi, D. Nogami, T. Minezaki, Y. Moritani, Y. Yatsu
- Amateur astronomers transient finding